

Refining a Conceptual Hydrogeologic Model at SNL/NM Using the Variable-Focus Colloidal Borescope

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The variable-focus colloidal borescope is used for measuring local groundwater flow velocity and direction by observing colloid transport in the water column of a well. The borescope consists of a waterproof video camera, flux gate compass, 36-136X variable-focus lens, and adjustable illumination source. Digitized images of suspended colloids are processed in real time by a computerized particle tracking algorithm. The borescope measures horizontal velocities as low as 0.09 m/d and resolves discrete flow intervals over a 500 mm focal range. The instrument can also qualitatively identify vertical flow. The scale over which borescope measurements are valid is dependent on subsurface heterogeneity.

At Sandia National Laboratory, New Mexico (SNL/NM), Technical Area V posed challenges to developing a conceptual hydrogeologic model due to a diffuse contaminant plume, low well density, flat groundwater gradient, and a depth to water greater than 160 m that results in high drilling costs. Data were collected with the colloidal borescope in five wells in November 1996. The colloidal borescope measured groundwater flow directions of southeast to west, depending on well location. Velocities ranged from 0.35 to 1.0 m/d. Only horizontal, laminar flow was observed. At SNL/NM, this information refines the Technical Area V conceptual model by evaluating local groundwater flow direction and velocity, and will be used to help identify the contaminant release location and to site future monitor wells.

The borescope can be an important tool for measuring local flow parameters near release sites, extraction systems, or engineered subsurface barriers. The borescope data, when combined with other geologic information, can result in more cost-effective characterization and remediation.

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